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Sir:

Transmitted herewith for filing is a patent application of

Inventors: Millington, et al

For: SELECTIVE RENDERING OF CARTOGRAPHIC ENTITIES FOR A NAVIGATION SYSTEM

Enclosed are:

X 4 sheets of drawings.X An Assignment of the invention to Magellan DIS   A certified copy of a \_\_\_\_\_ application.X A Combined Declaration and Power of Attorney   An associate power of attorney.   A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27.X PTO Form 1449 with copies of patents cited in specification.

The filing fee has been calculated as shown below:

	No. Filed	No. Extra	Small Entity		Large Entity	
Basic Fee				\$345		\$690
Total Claims	30	10	X9	-0-	X18	180
Indep. Claims	3	0	X39	-0-	X78	-0-
Multiple Depend. Claim(s) Present			\$130	-0-	\$260	-0-

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A duplicate copy of this sheet is enclosed.

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**SELECTIVE RENDERING OF CARTOGRAPHIC ENTITIES**  
**FOR A NAVIGATION SYSTEM**

**BACKGROUND OF THE INVENTION**

5           This invention relates to vehicle navigation systems and, more specifically, to map images appearing on a navigation system video screen of a display device.

Vehicle navigation systems typically include a display device with a video display that provides a graphical interface for the user. A main function of the video display is to depict the desired map area and route on which the user's vehicle is travelling. The map area shows various cartographic features, such as lakes and golf courses, to increase the utility to the user. These cartographic features are represented by cartographic entities that convey the nature of the cartographic feature so that the user may easily interpret it. For example, a solid green body may be used to represent a golf course and a solid blue body may be used to represent a lake. The map area shown on the video display may have numerous cartographic entities displayed making the vehicle route, which is typically the user's primary interest, more difficult to identify. That is, the sheer number of cartographic entities displayed on the video display distracts the user and increases the amount of time it takes the user to locate the vehicle route on the video display. Additionally, displaying numerous cartographic entities increases the time it takes to regenerate or update the video display, which may cause an undesirable delay in displaying the updated information to the user as the vehicle moves across the map area. Furthermore, the intensity of the vehicle route and other roads in the map area are the same, making it difficult to quickly identify the vehicle route.

Depending upon the operational mode of the navigation system, it may be desirable to vary the intensity of certain roads and/or have fewer or less detailed cartographic entities displayed such as described above. However, in some operational modes it may be desirable to

display cartographic entities for all the cartographic features. Therefore, it is desirable to selectively display cartographic entities based upon the operational mode of the vehicle navigation system. In this manner, the user may be provided the desired level of map details and have the video display regenerated rapidly.

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### SUMMARY OF THE INVENTION AND ADVANTAGES

The present invention provides a method of selectively displaying cartographic features on a video display of a navigation system for improved rendering. The method includes the steps of determining an operational mode of the navigation system, selecting a  
10 desired cartographic entity for a cartographic feature based upon the operational mode, and displaying the desired cartographic entity on the video display. For example, less detailed cartographic entities are selected for display when the navigation system is in an operational mode that requires the video display to be updated frequently.

Accordingly, the above invention provides the desired level of map details and have  
15 the video display regenerated rapidly.

### BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying  
20 drawings wherein:

Figure 1 is a schematic view of the vehicle navigation system of the present invention;

Figure 2 is a front elevational view of the vehicle navigation system display unit having a video display;

Figure 3 is the video display of the display unit in a first operational mode;

Figure 4 is the video display of the display unit in a second operational mode; and  
 Figure 5 is the video display of the display unit in a third operational mode.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5 The navigation system 20 of the present invention is shown schematically in Figure 1. The navigation system 20 includes a CPU 22 (Central Processing Unit) connected to a display device 24 and a directional input device 26 attached to the vehicle interior by a bracket 27, or the like. The navigation system 20 further includes a database 28 connected to the CPU 22. The database 28 is a mass media storage device, such as a CD-ROM, hard drive, DVD, RAM,  
 10 ROM or the like which includes a map of the road system in the area to be traveled by the user. Each road in the database is divided into road segments, each having an associated set of cost values, which indicate the "cost" of traveling that road segment. For example, the cost values may include the length of the road segment, the estimated time to travel the road segment, and the type of road (i.e., highway, secondary road, toll road, one way, etc.). The road segment may  
 15 be part of the vehicle route or may be a road segment outside the vehicle route.

The database 28 also stores the type location and shape of the cartographic features and entities like: ocean or coastline, river, canal, water channel, lake, bay or harbor, golf course, railroad, island, city, Native American reservation, built up area, county, country, state, national park or monument, state park, city or county park, woodland, shopping center, university or  
 20 college, cemetery, sports complex, hospital, airport, military base, pedestrian zone, aircraft road, industrial complex, or junction. Of course, the above list of cartographic features is only illustrative of the cartographic features that may be included on a map.

The navigation system 20 can, but need not, be installed in a vehicle 32. The navigation system can be used in conjunction with position determining devices, such as a GPS receiver 34

and a multi-axis accelerometer 35. Navigation system 20 could alternatively or additionally include a gyroscope 36, a compass 38, and a wheel speed sensor 40, all connected to the CPU 22 (connections not shown for simplicity). Preferably, a combination of these position determining devices is utilized to assure accurate location.

5           Figure 2 is a perspective view of one disclosed embodiment of the display device 24 and directional input device 26, preferably designed as an integral unit attached to the CPU by connection 25. The display device 24 includes a video display 50, or screen, such as a high resolution LCD or flat panel display. The directional input device 26 includes a multiple of input buttons 78 including, preferably, an eight-way button shown generally at 80 and a selection key 86 such as an "Enter" key. Although an eight-way button is shown, it will be realized that other input devices, such as a joystick, mouse or roller ball can be employed.

10           The internal disk 82 is pivotally mounted in the eight-way button 80 and is capable of moving in the direction of any one of the directional arrows 84. Movement of the internal disk 82 in the direction of one of the directional arrows 84 transmits a directional signal.

15           Figures 3 – 5 are video displays of the same map area in different operational modes using the present invention. Figure 3 depicts the video display 50 for a particular map area 51 when the navigation system is in an on-road guidance mode. In on-road guidance mode, the vehicle route 52 is highlighted in a bright color, such as magenta, and arrows 54 overlay the route for easy identification by the user. On-road guidance mode is typically used when the user selects a particular destination. The navigation system then selects and highlights the route 52 based upon certain user selected parameters, such as shortest distance or shortest time. Since the intended focal point of the map area is the vehicle route 50, it is desirable that there be fewer and less detailed cartographic entities for the cartographic features in the map area. In this patent application cartographic feature means an aspect of the map area, such as a lake, golf

course, forest, mountain, or sports arena. Cartographic entity means the icon used to represent the particular cartographic feature, such as a tree used to represent the location of a woodland in the map area. Road segments are the cartographic entities used to represent the cartographic feature of a road system.

5 In the on-road guidance mode shown in Figure 3, a golf course 56 is represented by a cartographic entity defined by a perimeter having cross-hatching within the perimeter. The lines of the cartographic entity are green and are easily regenerated compared to a similarly shaped cartographic entity that is solid. A similar cartographic entity with blue lines is used to represent a lake 58, with the cross-hatching oriented in a different direction so that a user may  
10 more easily distinguish the lake from the golf course. Not all the cartographic features may be displayed in on-road guidance mode. In the preferred embodiment, cartographic entities for the following cartographic features would be displayed: ocean or coastline, river, canal or water channel, lake, bay or harbor, golf course and railroad.

As mentioned above, the road system 44 includes road segments 46. In on-road  
15 guidance mode, one of the road segments 46 is the vehicle route 52. Although the vehicle route 52 may be a different color than the other road segments 46, the vehicle route 52 may not stand out due to the number of cartographic entities being displayed or because of their similar entities. With the present invention, during on-road guidance mode the vehicle route 52 is displayed at full intensity while the other cartographic entities, including road segments, rivers,  
20 lakes, etc., are displayed at a lower intensity. Typically, the cartographic entities are displayed using a color palette having blue, green and red values. For cartographic entities displayed at a lower intensity, the blue, green, and red values may be decreased by an equal percentage, preferably approximately twenty-five percent.

Figure 4 depicts the video display 50 for a particular map area 51 when the navigation system is in on-road mode. In on-road mode, no particular destination has been selected by the user. In this mode more detail may be desired than in on-road guidance mode because the user has not necessarily decided upon a particular route and knowledge of cartographic features may be more important to the user. Accordingly, it may be desirable to have the cartographic entities displayed more prominently so that they may be more quickly focused upon by the user. The golf course 56 and lake 58 are defined by the perimeter with solid shading so that the cartographic entity stands out. Not all the cartographic features may be displayed in on-road mode. In the preferred embodiment, cartographic entities for the following cartographic features would be displayed: ocean or coastline, river, canal or water channel, lake, bay or harbor, golf course and railroad.

Figure 5 depicts the video display for a particular map area when the navigation system is in off-road mode. In off-road mode, the navigation system has determined that the vehicle is no longer on any known road and that the vehicle is travelling off the road. It is important that the user be aware of the surrounding cartographic features since the user is no longer utilizing known roads. To this end, preferably cartographic entities for all the cartographic features are displayed using the most detail. Cartographic features may now be seen by the user that could not be seen in on-road guidance and on-road modes. For example, mountain 60, river 62, and tree 64 cartographic entities are displayed representing the mountain, river, and woodland cartographic features. Other cartographic features for which cartographic entities are now displayed are: island, city, Native American reservation, built up area, county, country, state, national park or monument, state park, city or county park, woodland, shopping center,

university or college, cemetery, sports complex, hospital, airport, military base, pedestrian zone, aircraft road, industrial complex, and junction.

Particular cartographic entities may be displayed to customers having specific interests. For example, a utility company may be interested in utility poles or easement being displayed in  
5 a particular mode.

The navigation system may include other operational modes in addition to the modes described above. One such operational mode may involve vehicle speed. If the vehicle is travelling rapidly compared to the map area displayed on the video screen, the map area may have to be regenerated frequently. As a result, it may be desirable to provide fewer and less  
10 detailed cartographic entities to minimize delay in displaying the updated information to the user. Therefore, the navigation system may enter into an operational mode when a predetermined vehicle speed is reached. Such an operational mode is relative to the operational mode from which the navigation system is changing. For example, if the navigation system is currently on-road guidance mode, which has few and less detailed  
15 cartographic entities, there may be no visible change in the display 50 when the predetermined speed is reached. However, if the current mode is off-road, then when the predetermined speed is reached fewer and less detailed cartographic entities will be displayed.

The navigation system may enter another operational mode displaying fewer and less detailed cartographic entities when the user pans the displayed map area using the arrow  
20 button 80. Similar to the vehicle speed operational mode discussed above, the panning operational mode is relative to the operational mode from which the navigation system is changing.

The present invention provides a method of selectively displaying cartographic features on a video display of a navigation system. It is to be understood that any type of



cartographic entity may be used for a cartographic feature in a particular operational mode. That is, the present invention may be accomplished by displaying different cartographic entities than described above. In operation, the navigation system determines an operational mode of the navigation system. The operational mode may be manually selected by the user or automatically determined by the navigation system, such as when entering off-road mode. The navigation system then selects a desired cartographic entity for a cartographic feature based upon the operational mode. If the navigation system is in a mode where fewer cartographic entities are desired, the navigation system may select no cartographic entity for a particular cartographic feature. An example of this is shown in Figures 3 and 4 where no cartographic entity is selected for the river, woodland, and mountains. Finally, the navigation system displays the desired cartographic entity on the video display. Again, no cartographic entity may be selected for display.

The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

## CLAIMS

What is claimed is:

1. A method of selectively displaying cartographic features on a video display of a navigation system, the method comprising the steps of:
  - 5 a) determining an operational mode of the navigation system;
  - b) selecting a desired cartographic entity for a cartographic feature based upon the operational mode; and
  - c) displaying the desired cartographic entity on the video display.
- 10 2. The method of claim 1, wherein the navigation system includes first and second operational modes, and step b) includes selecting a less detailed desired cartographic entity for the first operational mode and selecting a more detailed desired cartographic entity than the less detailed desired cartographic entity for the second operational mode.
- 15 3. The method of claim 2, wherein the less detailed desired cartographic entity is no cartographic entity.
4. The method of claim 2, wherein the first operational mode comprises on-road mode and the second operational mode comprises off-road mode.
- 20 5. The method of claim 4, wherein a first cartographic entity is displayed when the navigation system is in off-road mode and said first cartographic entity is not displayed when the navigation system is in on-road mode.

6. The method of claim 4, wherein the navigation system includes a third operational mode comprising on-road guidance mode, and step b) includes selecting a least detailed desired cartographic entity that is one of the same as the less detailed desired cartographic entity and a less detailed version of the less detailed desired cartographic entity  
5 than the less detailed desired cartographic entity for the on-road mode.

7. The method of claim 2, wherein the first operational mode is defined by a predetermined vehicle speed.

10 8. The method of claim 2, wherein the first operational mode comprises a panning mode.

9. The method of claim 2, wherein the less detailed desired cartographic entity is defined by a perimeter with cross-hatching disposed within the perimeter and the more  
15 detailed desired cartographic entity is defined by the perimeter with solid shading disposed within the perimeter.

10. The method of claim 1, wherein step b) further includes selecting the desired cartographic entity relative to a focal cartographic entity.

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11. The method of claim 10, wherein the focal cartographic entity is a vehicle route having a first intensity, and step b) includes selecting a second intensity for the desired cartographic entity which is different than the first intensity.

12. The method of claim 11, wherein the operational mode comprises on-road guidance mode.

13. The method of claim 11, wherein the first and second intensities are selected  
5 from a color palette having a plurality of colors.

14. The method of claim 13, wherein each of the plurality of colors are defined by blue, green, and red values with the first intensity having first blue, green, and red values and the second intensity having second blue, green, and red values that are a percentage of the  
10 first blue, green, and red values, respectively.

15. The method of claim 14, wherein the first intensity is approximately twenty-five percent less than the second intensity wherein the first blue, green, and red values are approximately twenty-five percent less than the second blue, green, and red values,  
15 respectively.

16. An apparatus for a navigation system for selectively displaying cartographic features, the apparatus comprising:

at least one position determining device for providing a vehicle location signal;

a database having a map with cartographic features and cartographic entities for

5 representing said cartographic features;

a processor interconnected to said at least one positioning device and said database for determining the location of the vehicle relative to said map;

a video display connected to said processor for displaying an area of said map;

a plurality of operational modes each displaying said map area, wherein said processor  
10 determines an operational mode from said plurality of said operational modes and selects a desired cartographic entity for a cartographic feature based upon said operational mode, said processor displaying said desired cartographic entity on said video display.

17. The apparatus of claim 16, wherein said plurality of operational modes  
15 includes first and second operational modes, and said processor selects a less detailed desired cartographic entity for said first operational mode and selects a more detailed desired cartographic entity than said less detailed desired cartographic entity for said second operational mode.

20 18. The apparatus of claim 17, wherein said less detailed desired cartographic entity is no cartographic entity.

19. The apparatus of claim 17, wherein said first operational mode comprises on-road mode and said second operational mode comprises off-road mode.

20. The apparatus of claim 19, wherein a first cartographic entity is displayed when said apparatus is in said off-road mode and said first cartographic entity is not displayed when said apparatus is in said on-road mode.

5 21. The apparatus of claim 19, wherein said apparatus includes a third operational mode comprising on-road guidance mode, and said processor selects a least detailed desired cartographic entity that is one of the same as said less detailed desired cartographic entity and a less detailed version of said less detailed desired cartographic entity.

10 22. The apparatus of claim 17, wherein said first operational mode is defined by a predetermined vehicle speed.

23. The apparatus of claim 17, wherein said first operational mode comprises a panning mode.

15 24. The apparatus of claim 17, wherein said less detailed desired cartographic entity is defined by a perimeter with cross-hatching disposed within said perimeter and said more detailed desired cartographic entity is defined by said perimeter with solid shading disposed within said perimeter.

25. A method of displaying a road segment on a video display of a navigation system, the method comprising the steps of:

- a) determining an operational mode of the navigation system;
- 5 b) selecting a desired intensity for a desired cartographic entity relative to a focal cartographic entity based upon the operational mode; and
- c) displaying the desired cartographic entity on the video display at the desired intensity.

10 26. The method of claim 25, wherein the focal cartographic entity is a vehicle route having an intensity vehicle route and step b) includes selecting the desired intensity for the desired cartographic entity which is different than the vehicle route intensity.

15 27. The method of claim 26, wherein the operational mode comprises on-road guidance mode.

28. The method of claim 26, wherein the vehicle route intensity and desired intensity are selected from a color palette having a plurality of colors.

20 29. The method of claim 28, wherein each of the plurality of colors are defined by blue, green, and red values with the vehicle route intensity having first blue, green, and red values and the second desired intensity having second blue, green, and red values that are a percentage of the first blue, green, and red values, respectively.

30. The method of claim 29, wherein the desired intensity is approximately twenty-five percent less than the vehicle route intensity wherein the first blue, green, and red values are approximately twenty-five percent less than the second blue, green, and red values, respectively.



**SELECTIVE RENDERING OF CARTOGRAPHIC ENTITIES**  
**FOR A NAVIGATION SYSTEM**

**ABSTRACT OF THE DISCLOSURE**

5           A method of selectively providing cartographic features on a video display of a navigation system for improved rendering is provided. The method includes the steps of determining an operational mode of the navigation system, selecting a desired cartographic entity for a cartographic feature based upon the operational mode, and displaying the desired cartographic entity on the video display. For example, less detailed cartographic entities are  
10 selected for display when the navigation system is in an operational mode that requires the video display to be updated frequently ore a mode in which it is desirable to focus the user's attention on a different cartographic entity. The less detailed cartographic entity may have a lower intensity than or contrast less with surrounding cartographic entities. In this manner, the user may be provided the desired level of map details with the video display regenerated  
15 rapidly.

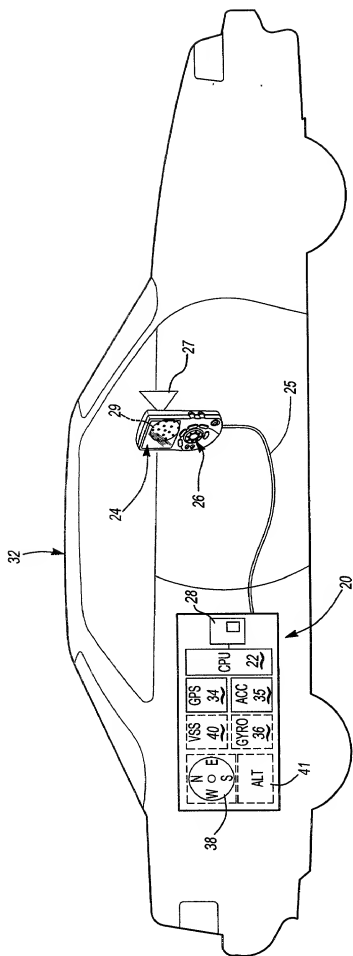
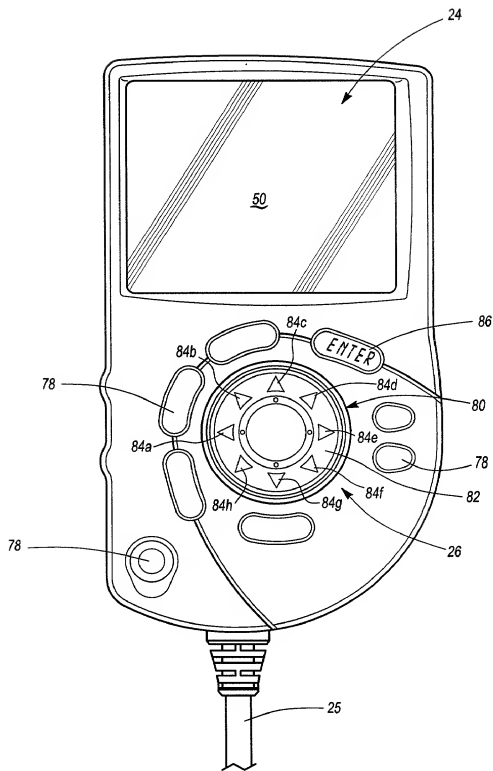
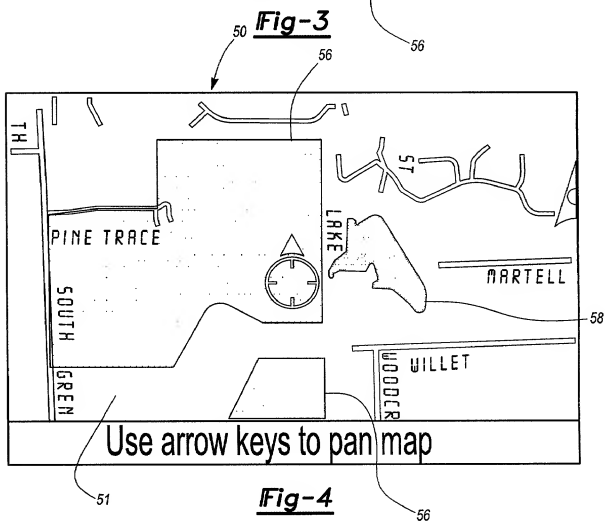
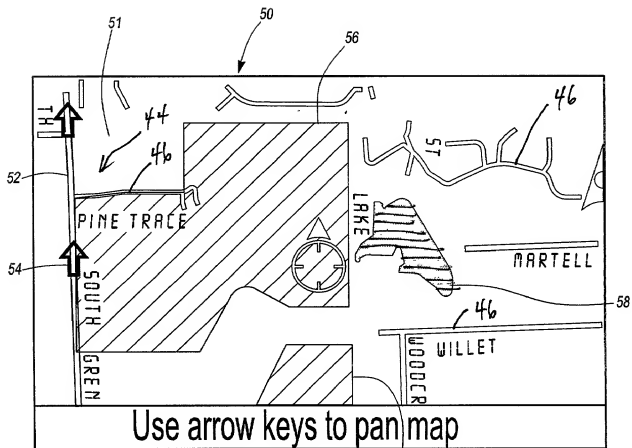
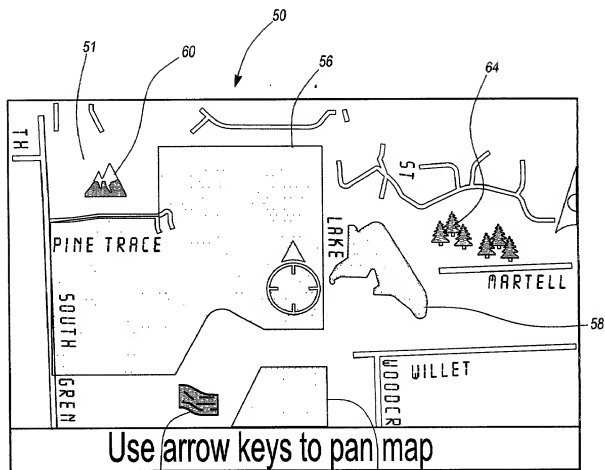


Fig-1



**Fig-2**





**COMBINED DECLARATION AND POWER OF ATTORNEY  
FOR UNITED STATES PATENT APPLICATION**  
(Original Application - Joint Inventors)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated near my name below.

I believe I am **original, first and joint inventor** of the subject matter of which is claimed and for which a patent is sought on the invention entitled:

**SELECTIVE RENDERING OF CARTOGRAPHIC ENTITIES FOR A NAVIGATION  
SYSTEM**

which is described and claimed in the specification of which:

  X   is executed on even date herewith; attorney docket number **60,314-110**

       was filed on   as United States Application Serial No. , and was amended on ; attorney docket number .

I declare that this application is:

  X   a first filing.

       a continuation.

       a continuation-in-part.

       a divisional.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I do not know and do not believe my invention was known or used by others in the United States of America, or patented or described in a printed publication in any country before my invention thereof.

I do not know and do not believe my invention was patented or described in a printed publication in any country or in public use or on sale in the United States of America, more than one year prior to this application.

I acknowledge my duty to disclose information of which I am aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim that no application for patent or inventor's certificate on this invention has been filed in any foreign country or in the United States of America prior to this application by me or my legal representatives or assigns except as follows:

### PRIORITY CLAIM

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of the foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

X no such applications have been filed.

\_\_ such applications have been filed as follows:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (month, day, year)	PRIORITY CLAIMED UNDER 37 USC 119
			Yes_ No_

I hereby claim priority to and all the benefits under Title 35, United States Code, §119(e) of any United States provisional application(s).

X no such applications have been filed.

\_\_ such applications have been filed as follows:

APPLICATION NUMBER	DATE OF FILING (month, day, year)

I hereby claim priority to and all the benefits under Title 35, United States Code, §120 of any United States application(s) listed below. If the above identified application is a continuation-in-part application, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this continuation-in-part application in accordance with Title 37, Code of Federal Regulations, Section 1.63(e).

X no such applications have been filed.

\_\_\_ such applications have been filed as follows:

APPLICATION NUMBER	DATE OF FILING (month, day, year)	STATUS (patented, pending, abandoned)
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#### POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorneys and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith with full power of substitution and revocation. (all names listed with corresponding registration numbers)

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**DECLARATION**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: 3/21/00

  
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